Cogongrass Seed Production Across Alabama and Georgia

by Nancy J. Loewenstein, James H. Miller and Stephen F. Enloe

Cogongrass is well known for its charismatic flowers in the spring. The showy, fluffy blooms are often the first sign of new infestations, and seeds can be the culprit responsible for long distance dispersal. Clearly, cogongrass is capable of prolific flowering (Figure 1), but the number of seeds produced by cogongrass infestations remains unclear.

Studies indicate that cogongrass seed viability is quite high (>90%) but that seed set can be variable (Shilling et al. 1997, Yager 2006). Flower fertilization in cogongrass, which is an obligate out-crosser, can only occur if plants of different genetic material are close enough for wind-dispersed pollen exchange. It is likely, therefore, that seed production will be higher in areas where cogongrass is common than where infestations are widely scattered and isolated. The potential for seed dispersal is an important consideration when developing cogongrass control strategies, especially for isolated infestations along the advancing front.

To begin to address this issue, we collected cogongrass seed heads from throughout Alabama and Georgia to determine if there are regional differences in cogongrass seed production and if outlying populations produce viable seed. Seed was collected within the occupied zone, the advancing front and from outlying infestations (Figure 2). Collections were a cooperative effort by Alabama and Georgia Forestry Commission personnel, Alabama Cooperative Extension System personnel and others. In 2008, 5 panicles (seed heads) were collected from each of 45 infestations (21 counties) in Alabama and 13 infestations in Georgia. In 2009, ten seed heads were collected from each of 116 sites (18 counties) in Alabama and 14 sites (8 counties) in Georgia. Seed heads were typically collected 10-14 days after flower initiation when the panicles were fluffy white, but before panicles began shedding seed. (See sidebar on page 9 with information about an ongoing project to track cogongrass flowering.)

Cogongrass seeds have no dormancy and seed viability was tested using a germination test. The length of each panicle was recorded, and then the entire panicle was placed in a petri dish lined with filter paper moistened with deionized water. Spikelets were spread out using a dissecting needle. Particularly large panicles were split between two plates to minimize crowding. The plate was sealed with Parafilm and placed in a growth chamber set on a 16 hr light/8 hr dark cycle with temperatures of 30 C/20 C, respectively. Plates were watered as needed. Very little microbial growth was observed on the plates (Figure 3), especially when immature panicles with anthers (male flower parts) were avoided. Seed germination was monitored for two weeks during 2008. Since most seed germinated within one week and to allow processing of more samples, the trial was reduced to a one week period in 2009. After the number of germinants were counted, percent germination was determined based on an estimate of 25 spikelets (potential seed) per centimeter of panicle (Shilling et al. 1997).

Figure 1 – Cogongrass infestation with large number of blooms. Flowering on this site was stimulated by a prescribed fire several months prior to blooming.

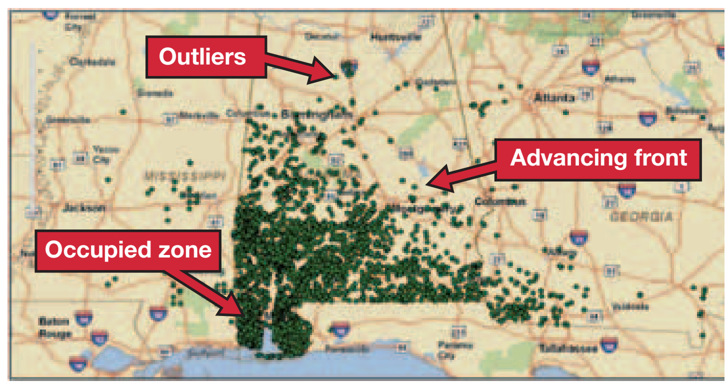

Figure 2 – Cogongrass infestations within Alabama and Georgia. (Map courtesy of the Alabama Forestry Commission - http://www.forestry.state.al.us/Viewers/afc_cogongrass_viewer.aspx)

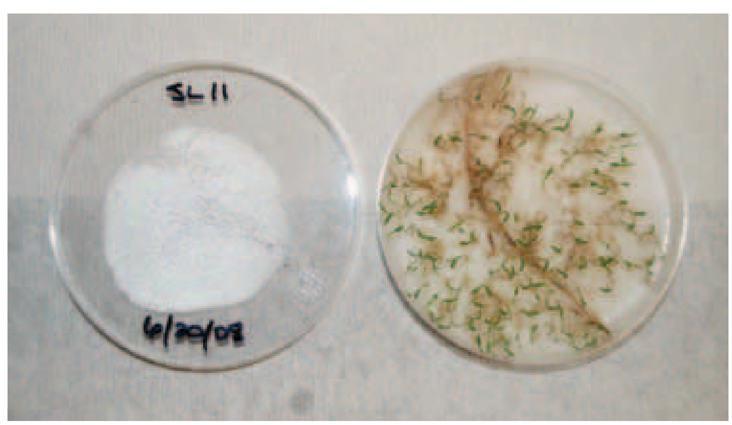

Figure 3 – Germinated cogongrass seed in petri dish.

Cogongrass infestations from within the heart of the "occupied zone" in Mobile and Baldwin counties in southwest Alabama produced considerably more viable seed than did populations from further north, in both 2008 and 2009 (Figure 4). However, the variability within and between infestations was quite high. For example, in samples collected from ten sites in Mobile County during 2009, the percentage of viable seed on individual panicles ranged from 0 to 80%, and the overall percentage of viable seed from all panicles collected from a site ranged from 0 to 47.7% (Table 1).

Despite the relatively high number of cogongrass infestations in the counties just north of Mobile and Baldwin counties, the number of viable seeds tended to be lower, and fewer of the sampled sites produced viable seed. However, the number of viable seed at some infestations was comparable to those of the fertile sites in Mobile and Baldwin counties. For instance, 37% viable seed was measured for one infestation in Clarke County in west central Alabama.

The number of viable seeds in samples from infestations along the advancing front was low (< 0.5%), but at least half of the infestations along the front in Alabama produced some viable seed. Similarly, five of the eight infestations sampled in Georgia during 2009 produced one or two viable seeds. Outlying infestations located well beyond the advancing front did not produce any viable seed.

Sources of variation thought to impact seed production include phenological differences in flowering within and between infestations (Figure 5), genetic composition of infestations, and distance between infestations. Weather and other environmental conditions could also impact timing of flower development and pollen dispersal. Unfortunately, we do not have

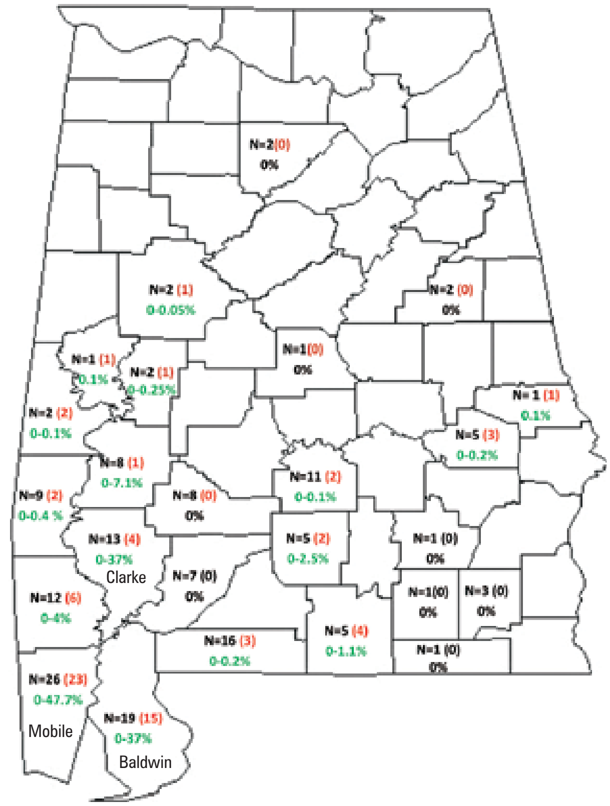

Figure 4 – Survey of cogongrass seed viability across Alabama, showing combined data from 2008 and 2009. The number of infestations sampled (N) in each county is indicated in black; number of infestations that produced viable seed is within parenthesis; the range in percent viable seed for the sampled infestations within the county is indicated in green. For example, only 15 of the 19 infestations sampled in Baldwin County produced viable seed, and the highest percentage of viable seed at any of the sampled infestations was 37%.

	Percent Viable Seed on Individual Seed Heads (number of viable seed in parentheses)										Mean
site 1	0	0	0	1.1 (2)	0	1.1 (2)	0.5 (1)	0	0	0	**0.3% (5)**
site 2	0	0	0.5 (1)	0	0	0.6 (1)	0	0	0.8 (2)	0	**0.2% (4)**
site 3	0	0	0	0	0	0	0	0	0	0	**0% (0)**
site 4	7.4 (13)	57.2 (93)	28.0 (56)	20.3 (33)	1.3 (2)	27.4 (48)	24.8 (31)	20.7 (31)	3.4 (6)	6.8 (11)	**19.7% (342)**
site 5	1.6 (3)	0	0	0	0	0	0.8 (2)	2.1 (5)	1 (2)	10.8 (23)	**1.6% (35)**
site 6	0.7 (1)	0	0	0	0	0	0.5 (1)	0	0	0	**0.1% (2)**
site 7	46.5 (93)	27.8 (59)	56.0 (105)	19.7 (32)	69.3 (130)	36.0 (54)	40.8 (107)	46.8 (117)	59.5 (119)	52.2 (111)	**45.5% (927)**
site 8	0	0.5 (1)	0	0	0	0.4 (1)	0.5 (1)	0	0	0	**0.1% (3)**
site 9	0	0	0	0	0	0	0	0	0	0	**0% (0)**
site 10	70.0 (105)	60.6 (106)	37.8 (104)	25.1 (47)	80.5 (151)	76.4 (86)	64.0 (104)	20.0 (25)	31.5 (63)	11.3 (17)	**47.7% (808)**

Table 1 – Percent viable seed on each of ten seed heads collected from ten cogongrass infestations in Mobile County, AL in 2009. The actual number of germinants is shown in parentheses. Percent germination is a function of the number of germinants and the length of the seed head. Means are shown in the last column.

Figure 5 – Example of phenological differences in flowering within cogongrass infestations.

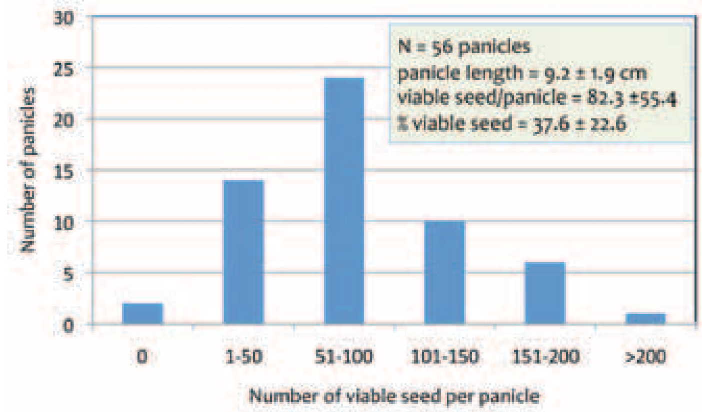

Figure 6 – Distribution of viable cogongrass seed on panicles collected within a quarter meter square plot at an infestation in southern Mobile County, AL.

the genetic, spatial and weather data required to test the impact of these sources of variation on our data.

A bell-shaped distribution in number of germinants per panicle was observed in a germination trial of all panicles (n=56) collected from a quarter meter quadrat in a site with high seed viability (Figure 6). In addition to inherent variation, this could reflect variation in flower age within the infestation and seed maturation within a panicle.

In conclusion, while production of viable cogongrass seed in Alabama and Georgia was variable across and within subregions, a significant number of viable seeds are produced by some infestations. For instance, an infestation with 937 viable seeds per 10 panicles (~45% germination) and a moderate 100 panicles/m^2 would produce 93.7 million seeds/hectare (37.9 million seeds/acre). Even an infestation with only 1 viable seed per 10 panicles (~0.1% germination) and a lower flowering rate of 50 panicles per square meter could produce 50,000 viable seeds per hectare (20,242 seeds/acre). Although spread of cogongrass by seed production from outlying infestations is not highly likely at this time, some seed production is occurring along the advancing front and seed dispersal cannot be ignored. This is especially true within the “occupied zone” where, to be safe, all seed should be considered viable. Steps to reduce spread by seed include spraying glyphosate just before flowering, not entering infestations during flowering and seed dispersal, and minimizing soil disturbance near infestations, as it is supposed that seed require bare soil for germination.

References

Shilling, D. G., Bewick, T. A., Gaffney, J.F., McDonald, S.K., Chase, C.A. and Johnson, E.R.R.L. 1997. Ecology, Physiology, and Management of Cogongrass *(Imperata cylindrica)*. Final report to Florida Institute of Phosphate Research, Publication No. 03-107-140. 128 p. www1.fipr.state.fl.us/fipr/fipr1.nsf/.../$FILE/03-107-140Final.pdf

Yager, L.Y. 2007. Watching the grass grow: Effects of habitat type, patch size, and land use on cogongrass (Imperata cylindrica (L.) Beauv.) spread on Camp Shelby training site, Mississippi. Dissertation, Mississippi State University. 194 p.

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New Website Maps Flowering Cogongrass

Owing to the threat posed by the spread and occupation of cogongrass in the South, it is imperative that we learn more about the progression of flowering in the region. Chuck Bargeron, Technology Director, University of Georgia’s Center for Invasive Species and Ecosystem Health, has created a reporting website where flowering sightings can be entered and mapped. The Website is: http://www.cogongrass.org/flowering

As of May 10, 2011, there have been 293 reports covering 132 counties by 174 people. Please continue to assist in this project as spring and summer progress.